Implementation for lower methane breeding

AGBU Summit 2023: Livestock Sustainability Indexes

Michael Aldridge, Andrew Swan, Sam Walkom, Brad Walmsley

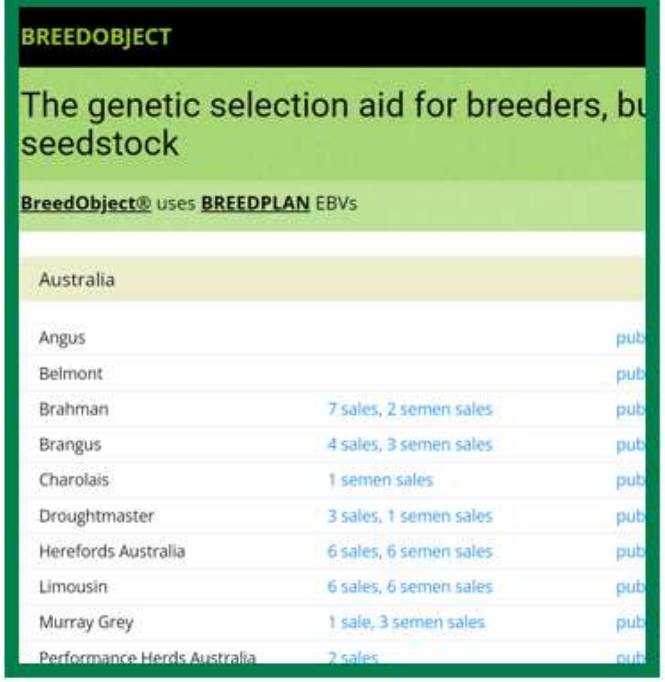
michael.aldridge@une.edu.au

agbu

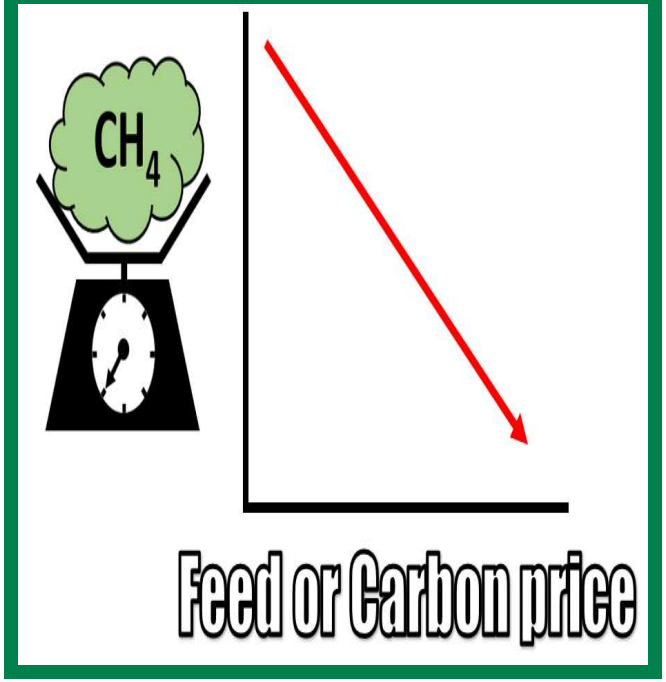
Australia's genetics institute for agriculture

Implementation of methane breeding

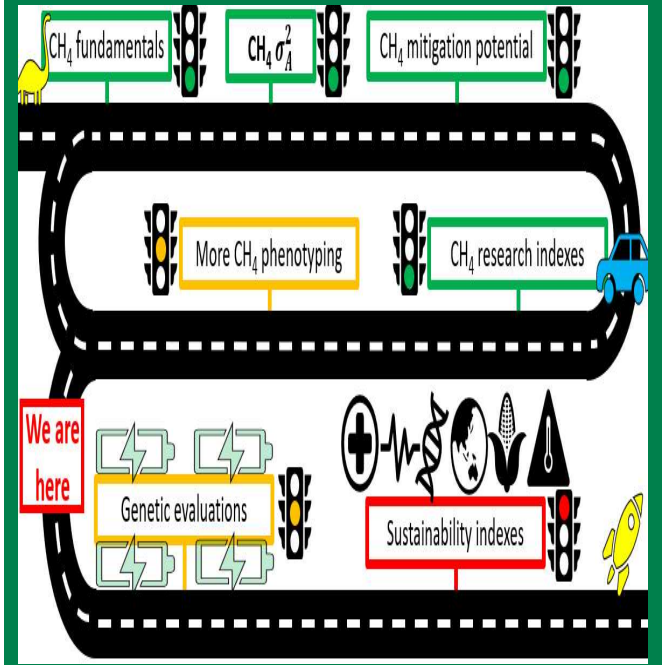
What is happening with CH_4 using current indexes?



Feed costs, carbon prices, CS, what happens to CH_4?

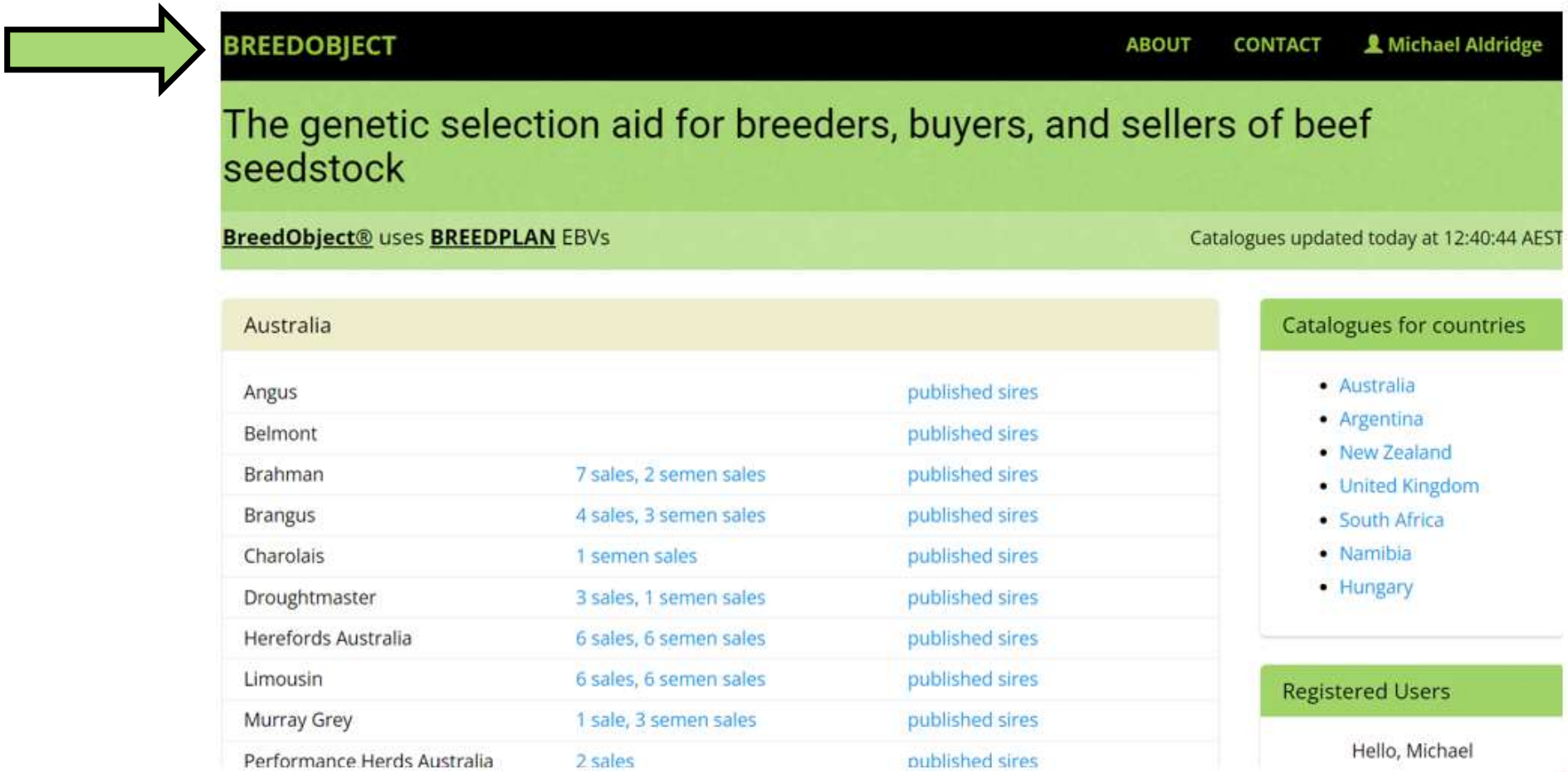


What do we need next, to breed for lower CH_4?



agbu

What is happening with CH4 using current indexes?



What is happening with CH4 using current indexes?

Grain Finished

- Following slides are a generalization

- Grain finished production system
    - Maintain current herd size
    - 200 cows joined per year
    - 600kg average cow weight at joining

- Grass finished has similar results (not shown)

agbu

What is the current index composition?

Grain Finished

Trait	Base scenario
Calving Ease – Direct	●●
Calving Ease – Maternal	●
Birth Weight – Direct	●
200-day Milk	●
200-day Growth	●
400-day Weight	●
600-day Weight	●●●
Mature Cow Weight	●●
Days to Calving	●●
Scrotal Size	
Carcase Fat Depth	●
Carcase Eye Muscle Area	
Carcase Retail Beef Yield%	●●
Carcase IMF%	●

agbu

What is the current index composition?

Grain Finished

Trait	Base scenario	Impact on methane production
Calving Ease – Direct	●●	
Calving Ease – Maternal	●	
Birth Weight – Direct	●	
200-day Milk	●	↑↑↑
200-day Growth	●	↑↑↑
400-day Weight	●	↑↑↑
600-day Weight	●●●	↑↑↑
Mature Cow Weight	●●	↑↑↑
Days to Calving	●●	↑↑
Scrotal Size		↑
Carcase Fat Depth	●	
Carcase Eye Muscle Area		
Carcase Retail Beef Yield%	●●	
Carcase IMF%	●	

agbu

Trait changes that impact methane?

Grain Finished

Trait	Trait Change
Weight (Weaning, Yearling, Finishing)	↑↑↑↑
Weight (Cow)	→ **Or** ↓
Feed intake	↓
Reproduction	↑

agbu

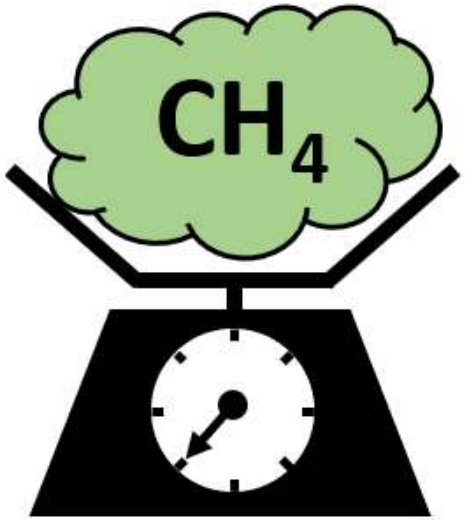
Trait changes that impact methane?

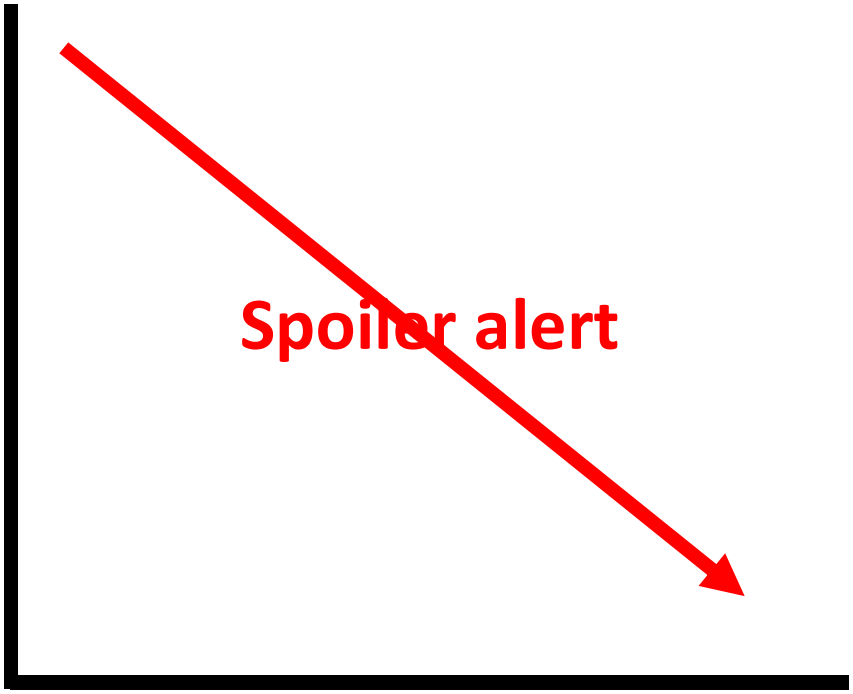
Grain Finished

Trait	Trait Change	Impact on methane production
Weight (Weaning, Yearling, Finishing)	↑↑↑↑	↑↑↑↑
Weight (Cow)	→ Or ↓	↓
Feed intake	↓	↓
Reproduction	↑	↑

agbu

Feed costs, carbon prices, CS, what happens to CH4?





Feed or Carbon price

What happens to methane when we…

- Increase feed costs?
- Add a carbon price?
- Change cow condition scores? (A little teaser)

What happens to methane when we…

Grain Finished

Increase feed costs?

- +30% feed cost
  - Additional feed cost = Carbon price
- Some take home observations

What happens to index composition when we increase feed price?

Grain Finished

Trait category	Base
Production	●●●
Carcase quality	●
Mature cow weight	●●
Reproduction	●●

What happens to index composition when we increase feed price?

Grain Finished

Trait category	Base	Feed cost +10%
Production	●●●	●●
Carcase quality	●	●
Mature cow weight	●●	●●
Reproduction	●●	●●

What happens to index composition when we increase feed price?

Grain Finished

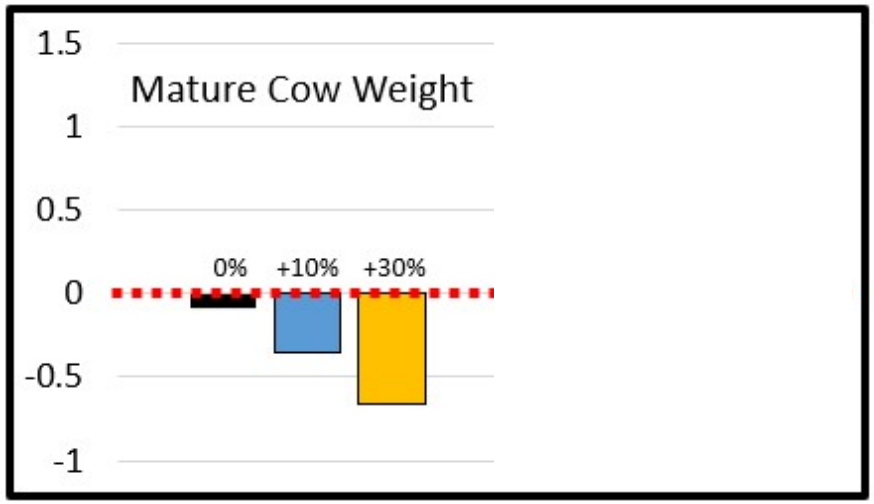
Trait category	Base	Feed cost +10%	Feed cost +30%
Production	●●●	●●	●
Carcase quality	●	●	●●
Mature cow weight	●●	●●	●●●
Reproduction	●●	●●	●

agbu

What happens when we change feed costs?

Grain Finished

Selection differential (Trait EBVs)



Selection differential (CH_4 EBVs)

Feed Price Change

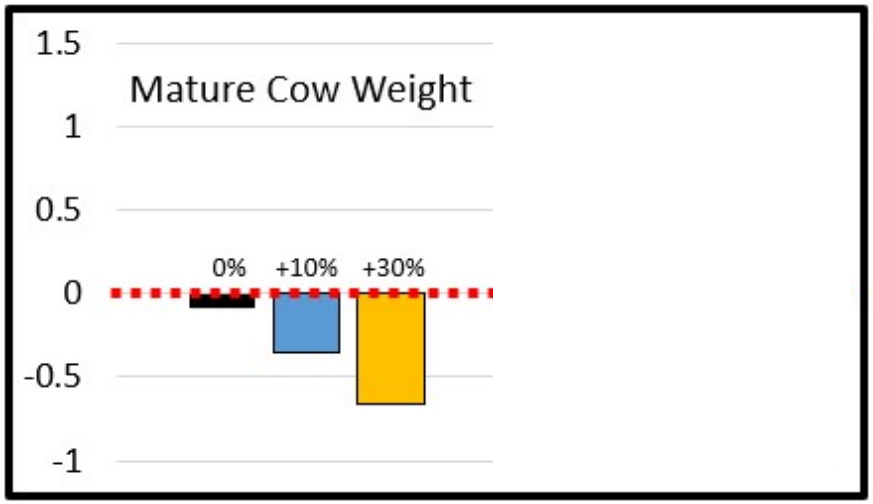
- 0% Base
- +10%
- +30%

agbu

What happens when we change feed costs?

Grain Finished

Selection differential (Trait EBVs)



Selection differential (CH_4 EBVs)

Feed Price Change

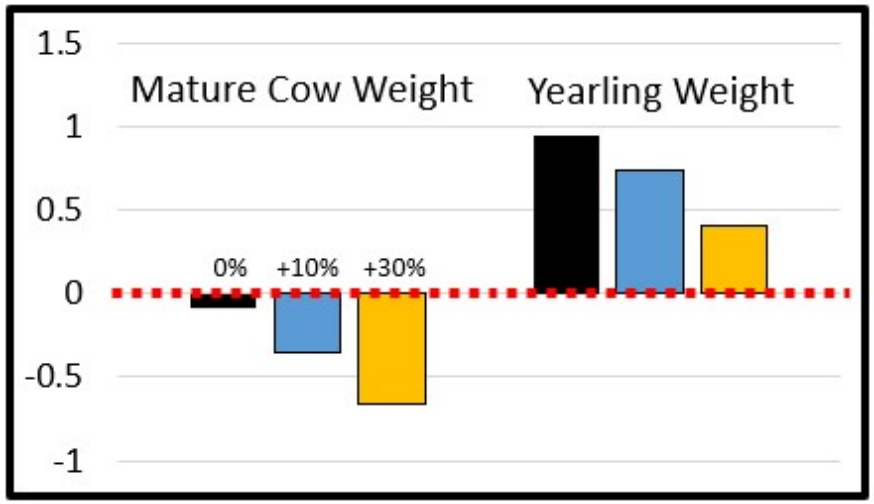
- 0% Base
- +10%
- +30%

agbu

What happens when we change feed costs?

Grain Finished

Selection differential (Trait EBVs)



Selection differential (CH_4 EBVs)

Feed Price Change

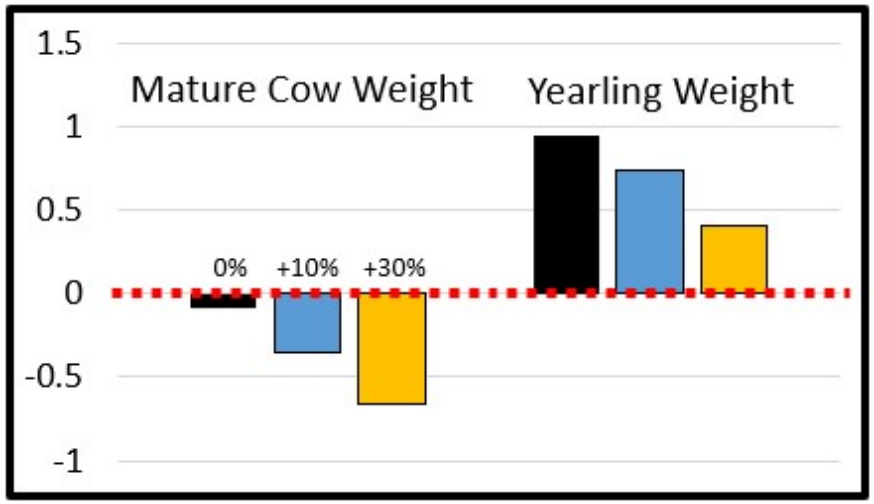
- 0% Base
- +10%
- +30%

agbu

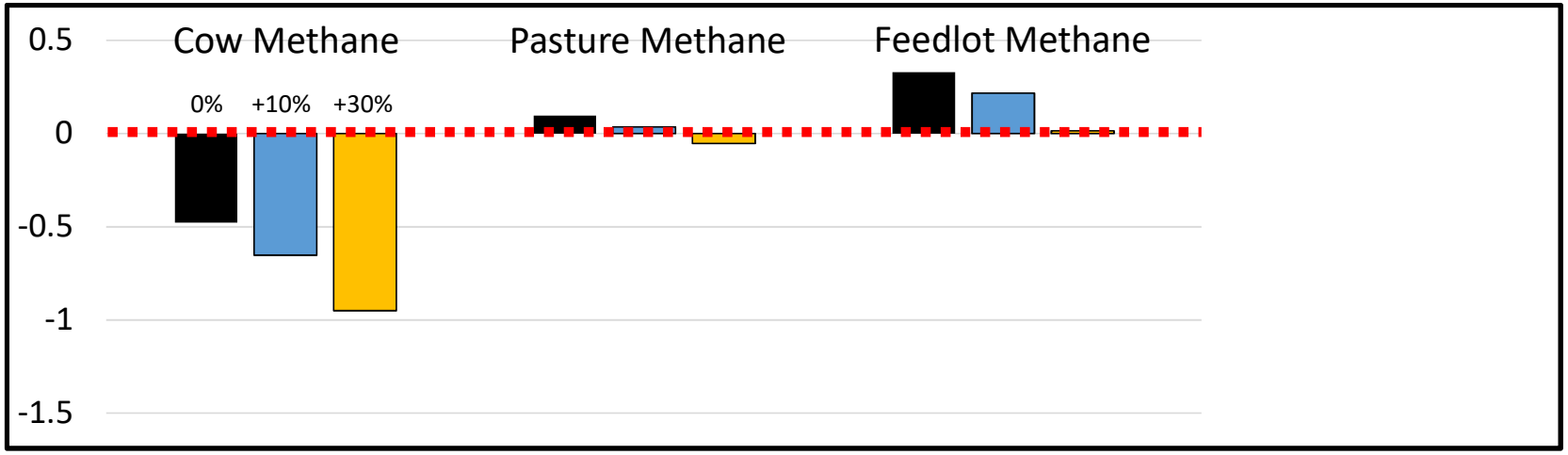
What happens when we change feed costs?

Grain Finished

Selection differential (Trait EBVs)



Selection differential (CH_4 EBVs)



Feed Price Change

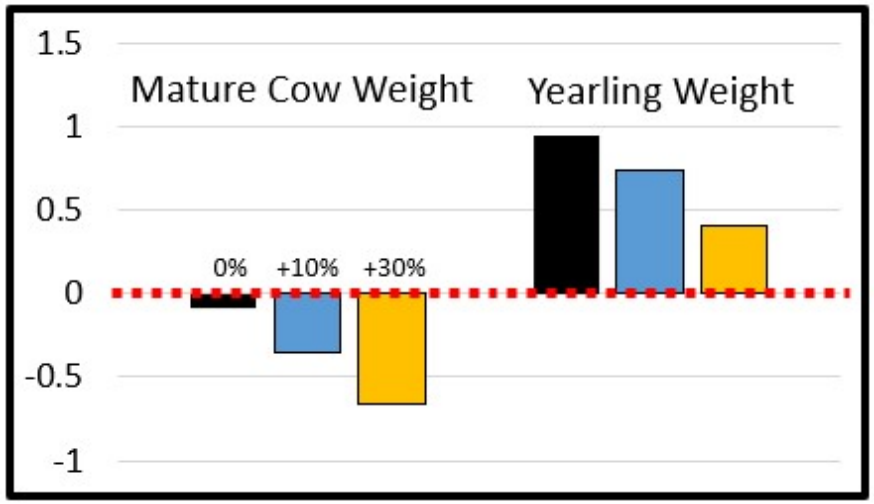
- 0% Base
- +10%
- +30%

agbu

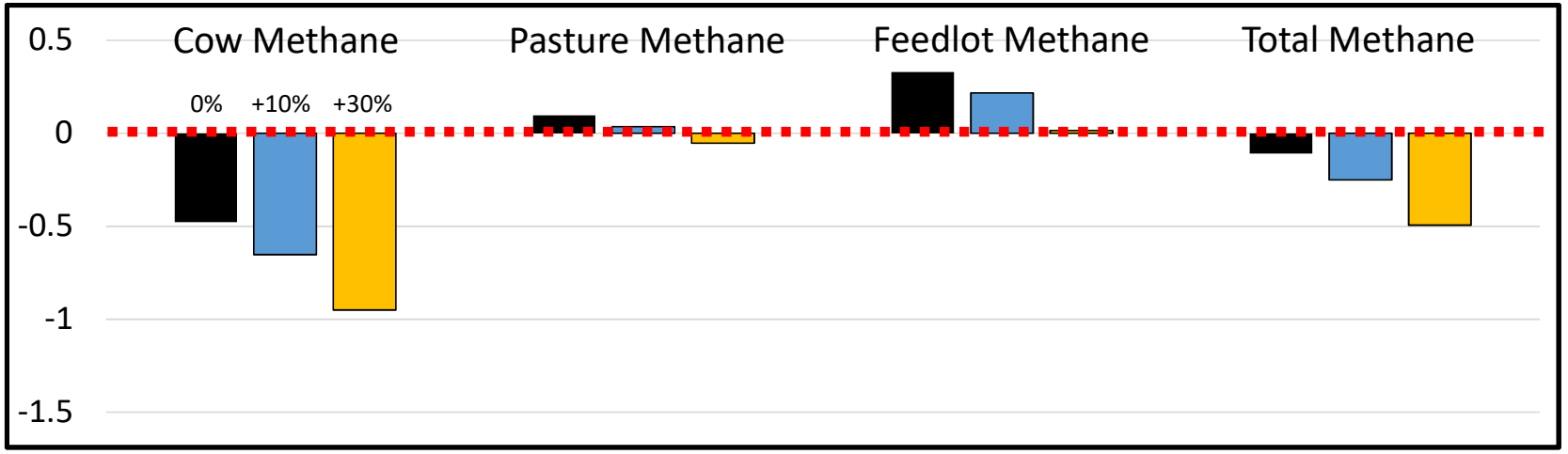
What happens when we change feed costs?

Grain Finished

Selection differential (Trait EBVs)



Selection differential (CH_4 EBVs)



Feed Price Change

- 0% Base
- +10%
- +30%

agbu

What happens to methane when we…

Grain Finished

- Increase feed costs ☑
- Add a carbon price?
- Change cow condition scores?

agbu

What happens to methane when we…

Grain Finished

- Add a carbon price?
  - $90/t CO_2-eq and $250/t CO_2-eq
  - Some take home observations

What happens to index composition when we add a carbon price?

Grain Finished

Trait category (by importance)	Base
Production	●●●
Carcase quality	●
Mature cow weight	●●
Reproduction	●●

agbu

What happens to index composition when we add a carbon price?

Grain Finished

Trait category (by importance)	Base	$90 / t CO_2-eq
Production	●●●	●●
Carcase quality	●	●
Mature cow weight	●●	●●
Reproduction	●●	●●

agbu

What happens to index composition when we add a carbon price?

Grain Finished

Trait category (by importance)	Base	$90 / t CO_2-eq	$250 / t CO_2-eq
Production	●●●	●●	↓
Carcase quality	●	●	●●
Mature cow weight	●●	●●	●●●
Reproduction	●●	●●	●

agbu

What happens to index composition when we add a carbon price?

Grain Finished

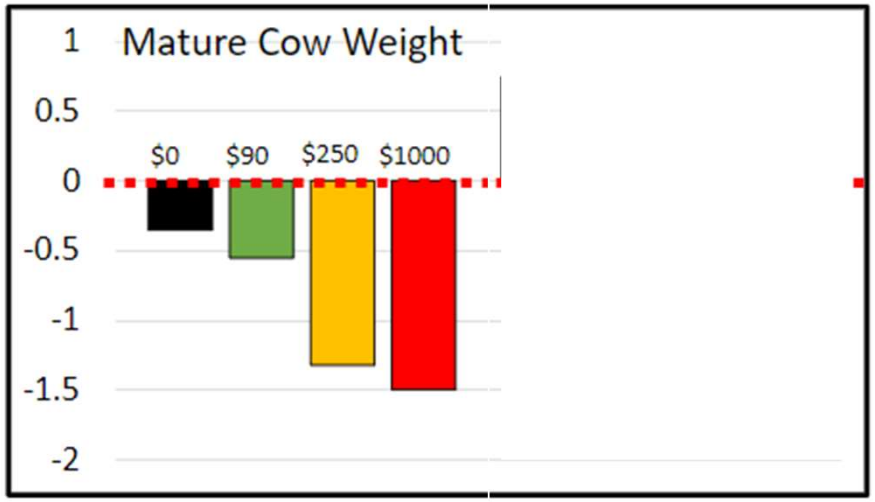
Trait category (by importance)	Base	$90 / t CO_2-eq	$250 / t CO_2-eq	$1000 / t CO_2-eq
Production	●●●	●●	↓	↓↓
Carcase quality	●	●	●●	●
Mature cow weight	●●	●●	●●●	●●●●
Reproduction	●●	●●	●	●

agbu

What happens when we add a carbon price?

Grain Finished

Selection differential (Trait EBVs)



Selection differential (CH_4 EBVs)

Carbon Price

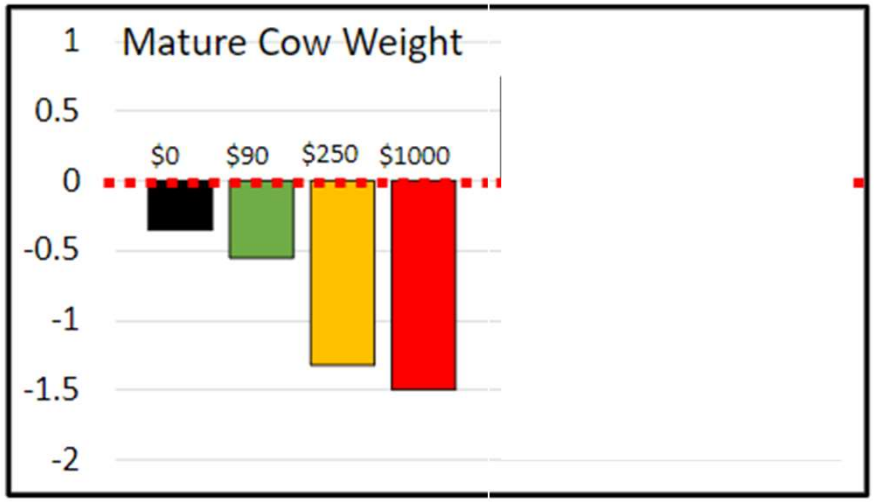
- Base
- $90/t
- $250/t
- $1000/t

agbu

What happens when we add a carbon price?

Grain Finished

Selection differential (Trait EBVs)



Selection differential (CH_4 EBVs)

Carbon Price

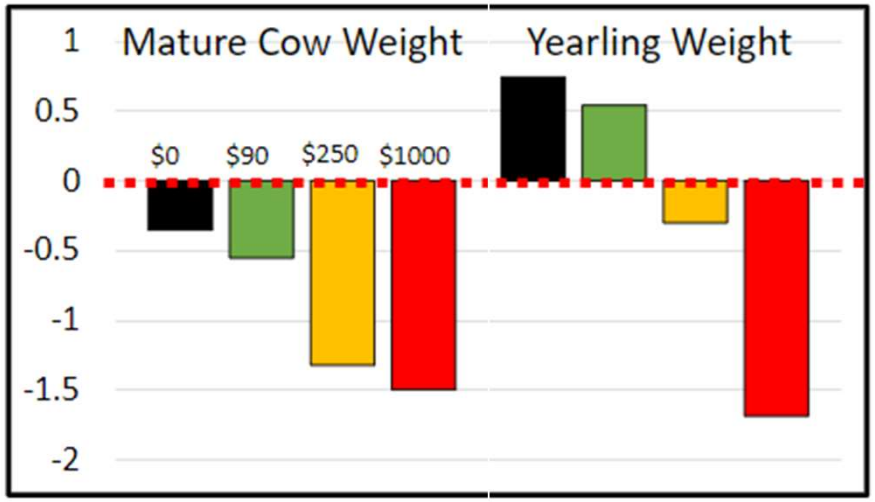
- Base
- $90/t
- $250/t
- $1000/t

agbu

What happens when we add a carbon price?

Grain Finished

Selection differential (Trait EBVs)



Selection differential (CH_4 EBVs)

Carbon Price

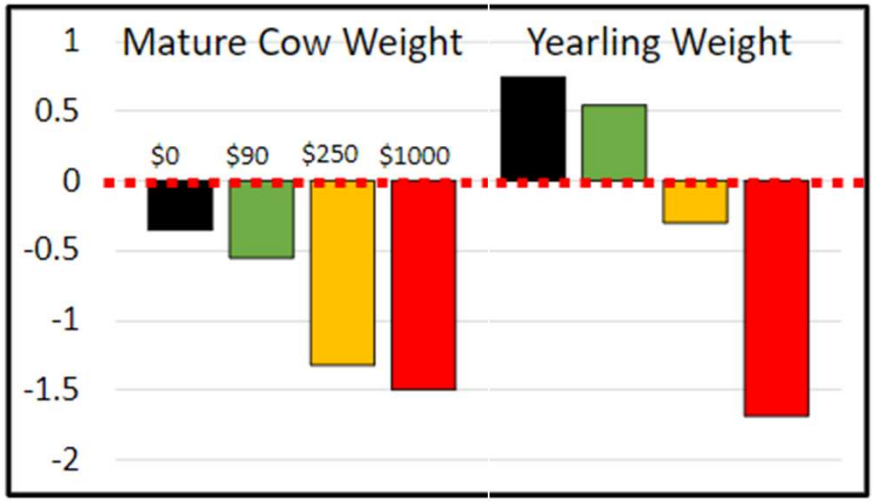
- Base
- $90/t
- $250/t
- $1000/t

agbu

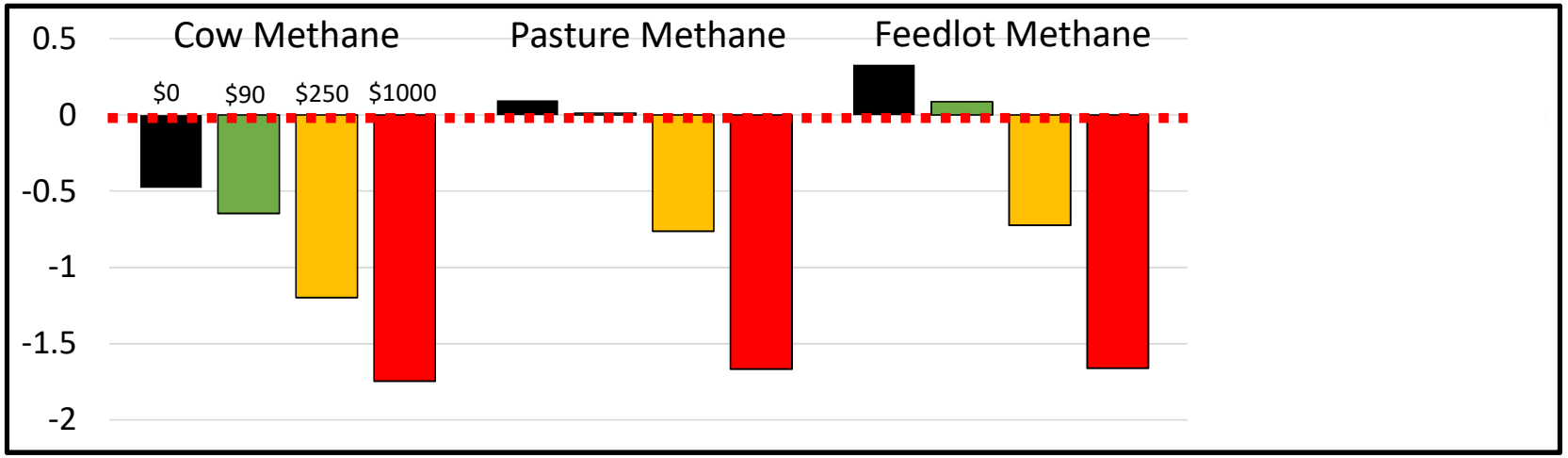
What happens when we add a carbon price?

Grain Finished

Selection differential (Trait EBVs)



Selection differential (CH_4 EBVs)



Carbon Price

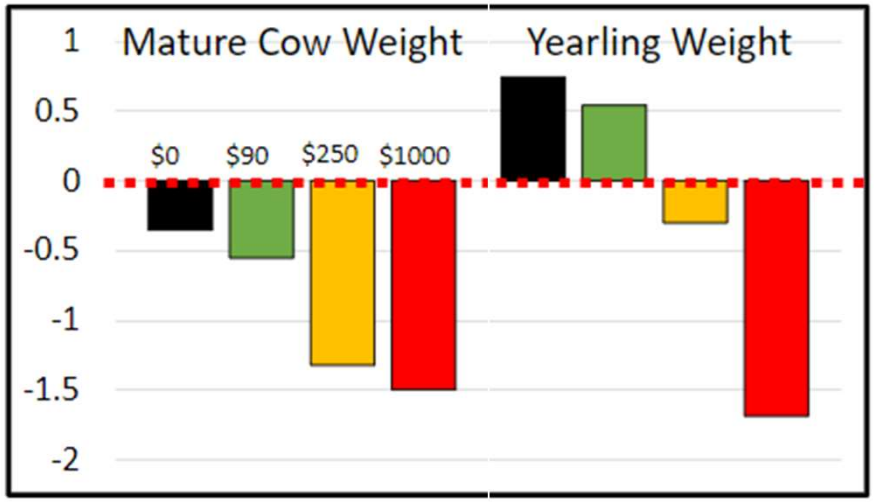
- Base
- $90/t
- $250/t
- $1000/t

agbu

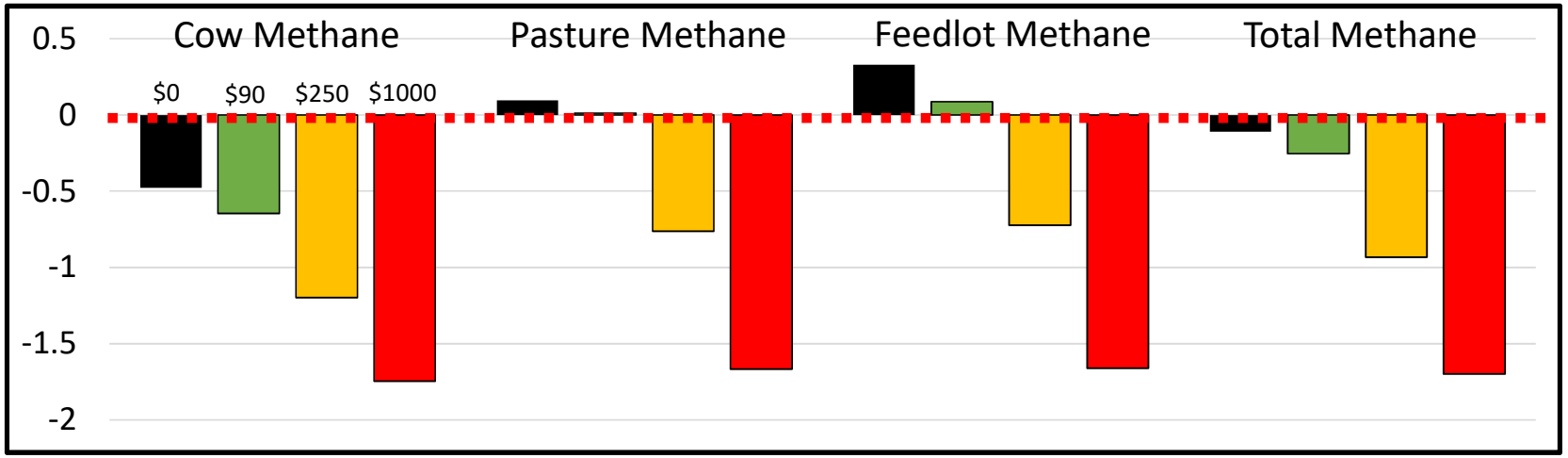
What happens when we add a carbon price?

Grain Finished

Selection differential (Trait EBVs)



Selection differential (CH_4 EBVs)



Carbon Price

- Base
- $90/t
- $250/t
- $1000/t

agbu

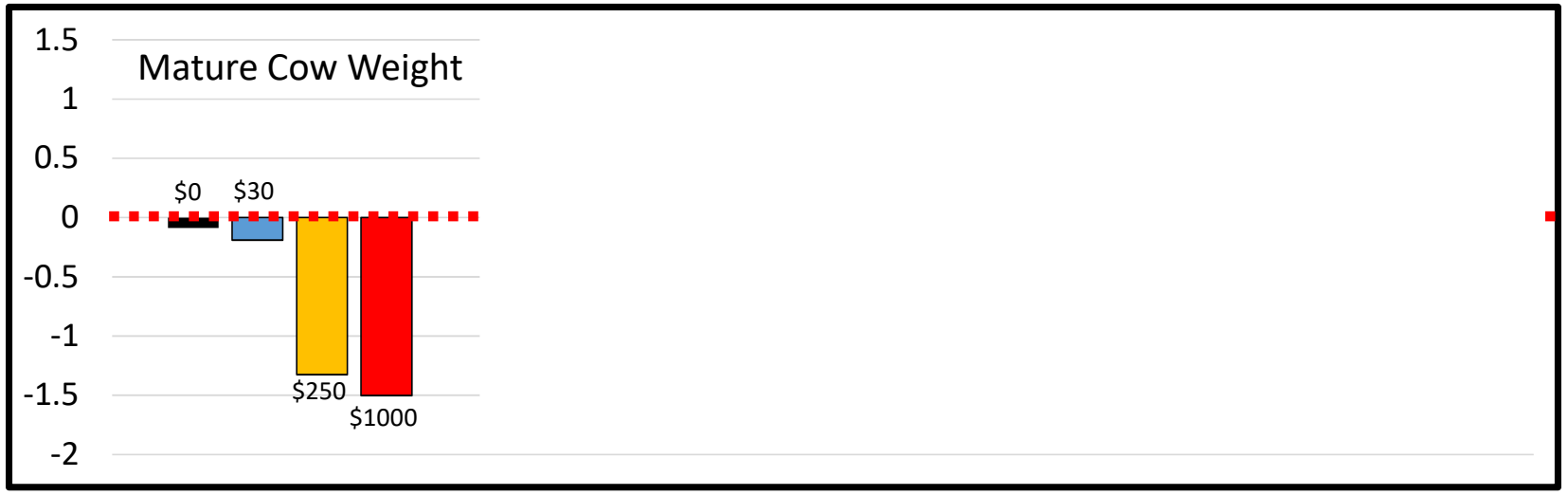
What happens when we add a carbon price?

Sheep

Selection differential (CH_4 EBVs)

Beef

Selection differential (CH_4 EBVs)



Carbon Price

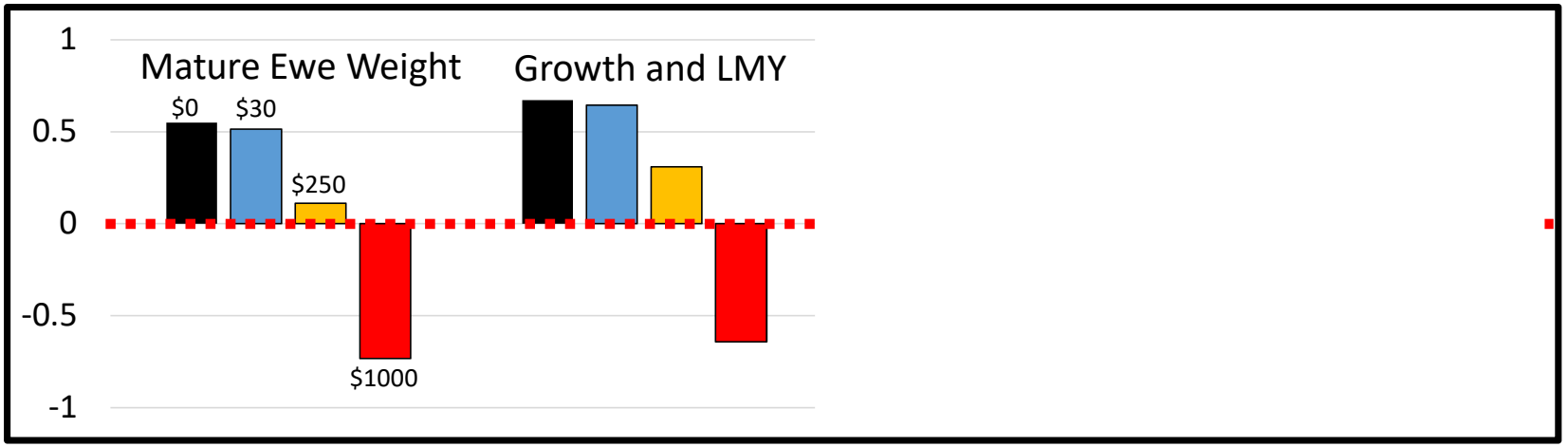
- Base
- **$30/t**
- $250/t
- $1000/t

agbu

What happens when we add a carbon price?

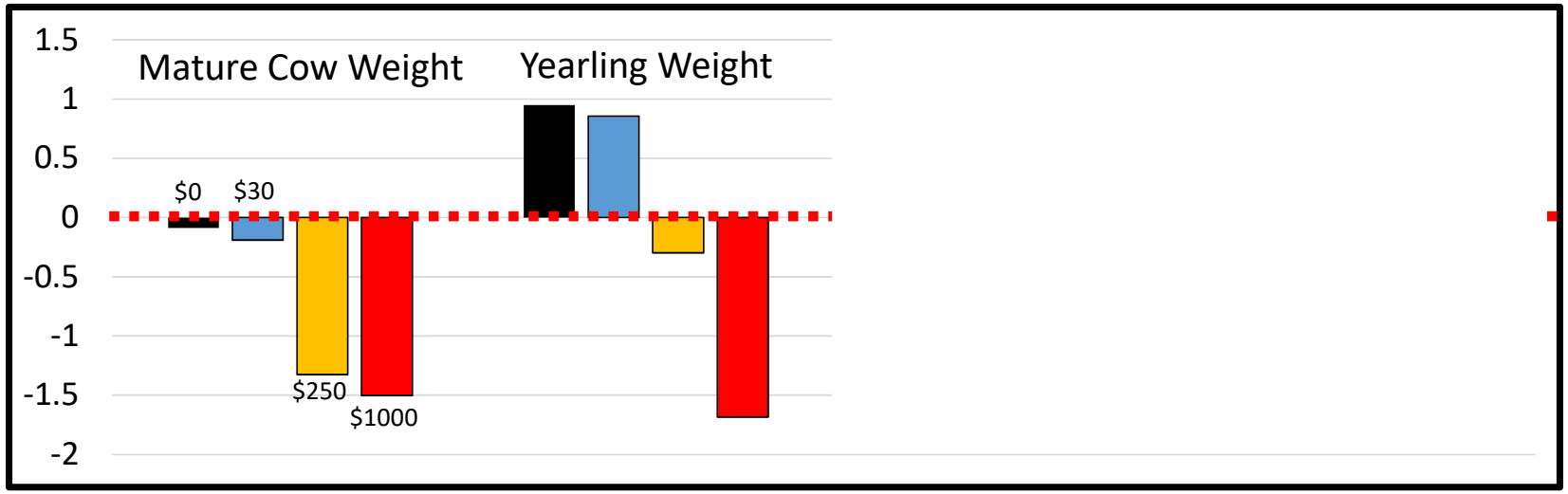
Sheep

Selection differential (CH_4 EBVs)



Beef

Selection differential (CH_4 EBVs)



Carbon Price

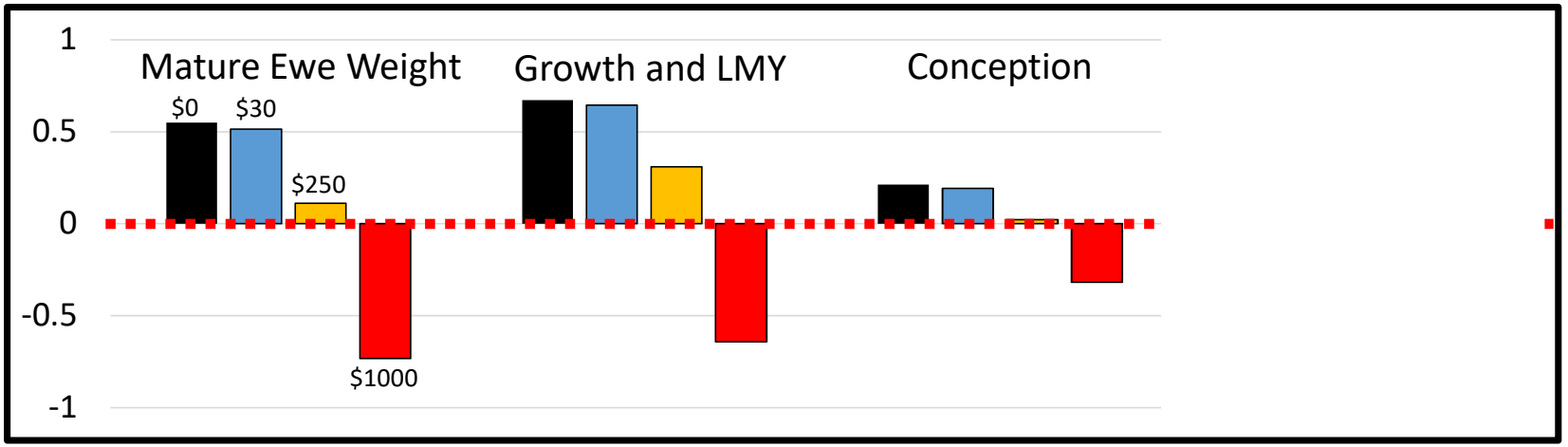
- Base
- **$30/t**
- $250/t
- $1000/t

agbu

What happens when we add a carbon price?

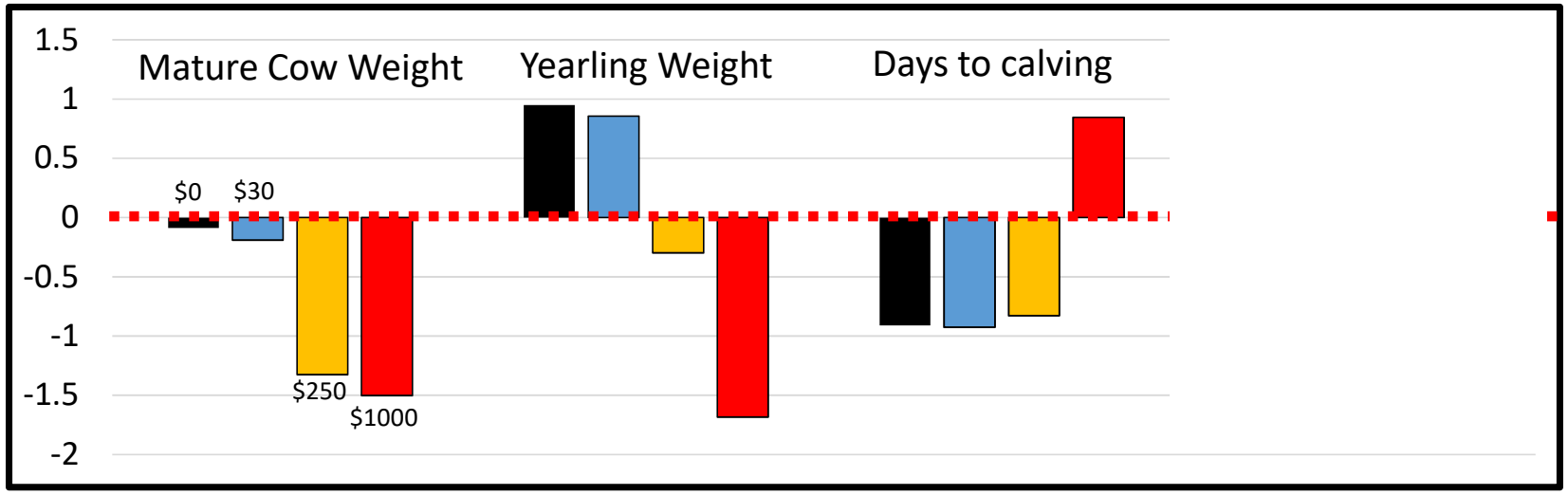
Sheep

Selection differential (CH_4 EBVs)



Beef

Selection differential (CH_4 EBVs)



Carbon Price

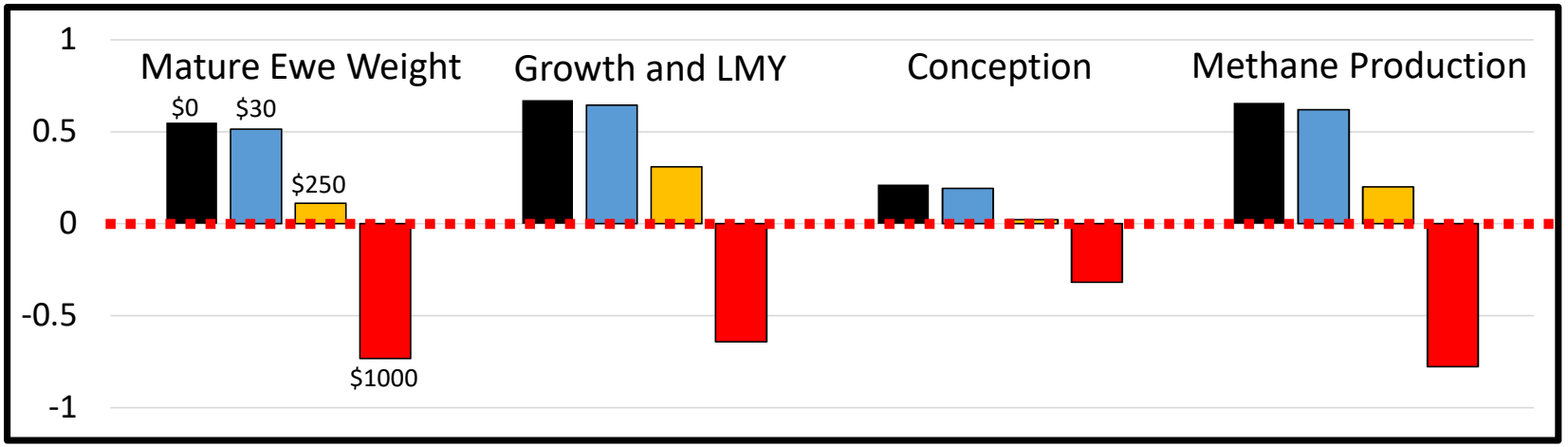
- Base
- **$30/t**
- $250/t
- $1000/t

agbu

What happens when we add a carbon price?

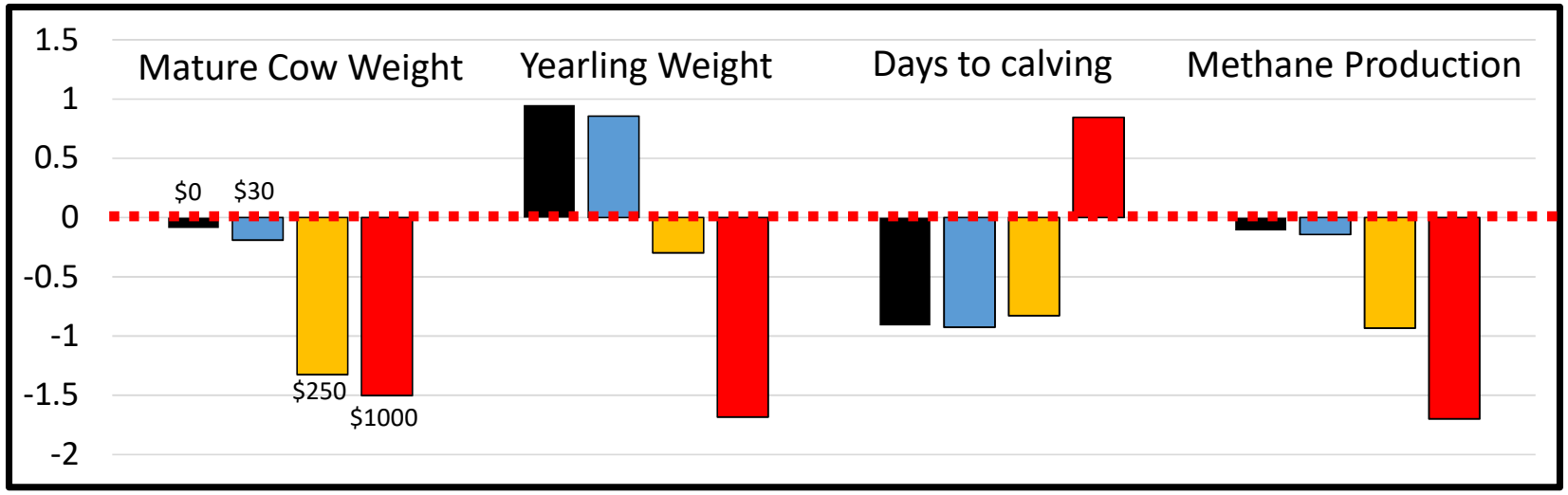
Sheep

Selection differential (CH_4 EBVs)



Beef

Selection differential (CH_4 EBVs)



Carbon Price

- Base
- **$30/t**
- $250/t
- $1000/t

agbu

What happens to methane when we…

- Decrease or increase feed costs ☑
- Add a carbon price ☑
- Change cow condition scores?

What happens to methane when we change condition score?

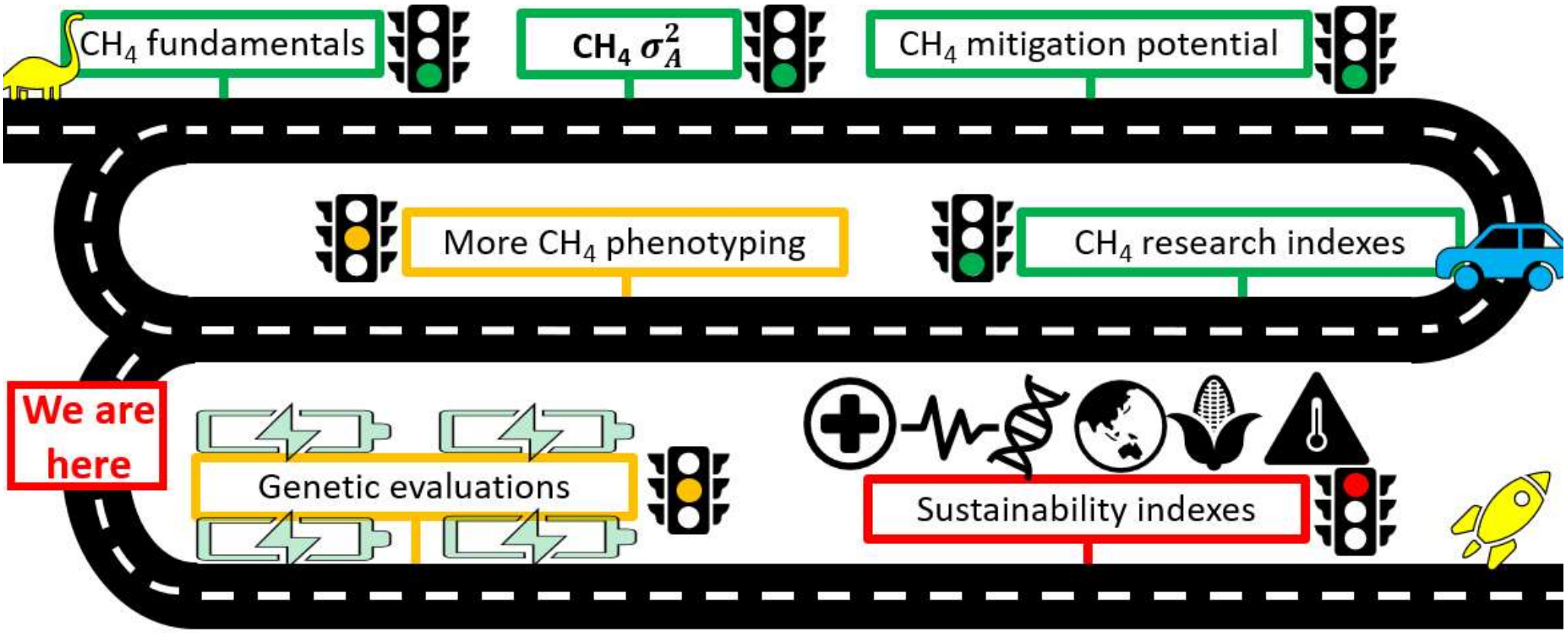
- Increasing or decreasing CS is undesirable for methane
  - High CS = cow eats more for no reason = more methane
  - Low CS = cow needs to eat more to get into condition = more methane

- Results not shown, more work is needed.

- The system of today, will not be the same system in 2030 or 2050.
  - Do we need a fundamental rethink?
  - What incentives will there be?

agbu

What do we need next, to breed for lower CH_4?



agbu

Take home messages

Feed cost can be used to select for lower methane

- +30% = strong driver for reducing methane
- +30% = smaller cows and still increase production

Carbon prices can be included

- $90/t = 30% feed cost
- $250/t = lower production, mean index value is negative, methane drops

Condition score

- Management and selection strategies should be investigated

agbu

Phenotypes, phenotypes, phenotypes

We can make progress using predicted methane production.

We'd make more progress with a direct measured methane trait.

We need genetic correlations and accurate breeding values.

There are projects that are collecting this data (see following talks).

With collaboration, direct methane can be added to BreedObject and SheepObject.

agbu

Two prongs approach

Prong 1. Start selection using predicted methane production.

- Are you using BreedObject v6 and have a higher feed cost?
- Then you're already on the right road to reduce methane.
- If you want to "*hit the gas*" we can do that.

Prong 2. Add a measured methane trait.

- Direct selection (Utilize genetic variation in residual methane production)
- Avoid the undesirable changes.

agbu

Implementation for lower methane breeding

AGBU Summit 2023: Livestock Sustainability Indexes

Michael Aldridge, Andrew Swan, Sam Walkom, Brad Walmsley

michael.aldridge@une.edu.au

agbu

Australia's genetics institute for agriculture